

Claims

What is claimed is:

- 1 1. A method for implementing automated detection of excess
2 aggressor shape capacitance coupling in printed circuit board (PCB) layouts
3 comprising the steps of:
4 receiving a PCB design file containing an electronic representation of
5 a printed circuit board design;
6 identifying a list of candidate shapes, said candidate shapes disposed
7 on layers adjacent to power planes;
8 calculating a capacitance coupling the candidate shapes to adjacent
9 noise-generating planes, and
10 determining a ratio of each said calculated coupling capacitance and
11 a decoupling capacitance connecting the respective candidate shape to a
12 reference plane.
- 1 2. A method for implementing automated detection of excess
2 aggressor shape capacitance coupling as recited in claim 1 includes the step
3 of sorting said determined ratios and providing a ranked list of shape names
4 using said sorted ratios.
- 1 3. A method for implementing automated detection of excess
2 aggressor shape capacitance coupling as recited in claim 2 wherein the step
3 of providing said ranked list of shape names includes providing said ranked
4 list of shape names with said determined ratio, an area, and a location of
5 said shapes.
- 1 4. A method for implementing automated detection of excess
2 aggressor shape capacitance coupling as recited in claim 1 wherein the step
3 of identifying said list of candidate shapes includes identifying said candidate
4 shapes disposed on layers adjacent to power planes and having an
5 assigned name that indicates usage for power distribution.

1 5. A method for implementing automated detection of excess
2 aggressor shape capacitance coupling as recited in claim 1 wherein the step
3 of calculating said effective capacitance coupling the candidate shapes to
4 adjacent noise-generating planes includes the steps of identifying an overlap
5 area of the candidate shapes to each adjacent noise-generating plane.

1 6. A method for implementing automated detection of excess
2 aggressor shape capacitance coupling as recited in claim 5 includes the step
3 of identifying data from said received PCB design file representing a
4 distance between the candidate shapes and said adjacent noise-generating
5 planes and permittivity of the dielectric layers.

1 7. A method for implementing automated detection of excess
2 aggressor shape capacitance coupling as recited in claim 1 wherein the step
3 of calculating said effective capacitance coupling the candidate shapes to
4 adjacent noise-generating planes includes the steps of calculating an inter-
5 layer parallel-plate effective capacitance represented by:

6
$$C_{pp} = eA/D$$

7 where,

8 A = Plane and candidate shape overlap area (Meter²)

9 e = $\epsilon_r \epsilon_0$, where ϵ_r represents relative permittivity

10 ϵ_0 equals a predefined constant value Farads/Meter; (permittivity of free
11 space)

12 D = the distance (Meters) between the candidate shape and the adjacent
13 plane.

1 8. A method for implementing automated detection of excess
2 aggressor shape capacitance coupling as recited in claim 1 wherein said
3 determined ratio of each said calculated effective capacitance and said
4 decoupling capacitance connecting the respective candidate shape to a
5 reference plane is used to produce a ranked list of the candidate shapes for
6 user review.

1 9. A computer program product for implementing automated
2 detection in a computer system of excess aggressor shape capacitance
3 coupling in printed circuit board (PCB) layouts, said computer program
4 product including instructions executed by the computer system to cause the
5 computer system to perform the steps of:

6 receiving a PCB design file containing an electronic representation of
7 a printed circuit board design;

8 identifying a list of candidate shapes, said candidate shapes disposed
9 on layers adjacent to power planes;

10 calculating an effective capacitance coupling the candidate shapes to
11 adjacent noise-generating planes, and

12 determining a ratio of each said calculated effective capacitance and
13 a decoupling capacitance connecting the respective candidate shape to a
14 reference plane.

1 10. A computer program product for implementing automated
2 detection as recited in claim 9 includes the steps of sorting said determined
3 ratios and providing a ranked list of shapes including a shape name, said
4 ratio, an area, and a location.

1 11. A computer program product for implementing automated
2 detection as recited in claim 9 wherein the step of identifying said list of
3 candidate shapes includes identifying said candidate shapes having a
4 predefined assigned name indicating usage.

1 12. A computer program product for implementing automated
2 detection as recited in claim 9 wherein the step of calculating said effective
3 capacitance coupling the candidate shapes to adjacent noise-generating
4 planes includes the steps of calculating an inter-layer parallel-plate effective
5 capacitance represented by:

6
$$C_{pp} = \epsilon A/D$$

7 where,

8 A = Plane and candidate shape overlap area (Meter²)

9 $\epsilon = \epsilon_r \epsilon_0$, where ϵ_r represents relative permittivity

10 ϵ_0 equals a predefined constant value Farads/Meter; (permittivity of free
11 space)

12 D = the distance (Meters) between the candidate shape and the adjacent
13 plane.

1 13. A computer program product for implementing automated
2 detection as recited in claim 9 includes the step of using said determined
3 ratio of each said calculated effective capacitance and said decoupling
4 capacitance connecting the respective candidate shape to a reference plane
5 to produce a ranked list of the candidate shapes for user review.

1 14. Apparatus for implementing automated detection of excess
2 shape coupling in printed circuit board (PCB) layouts comprising:
3 an excess shape coupling detection program for receiving a PCB
4 design file containing an electronic representation of a printed circuit board
5 design; for using said PCB design file for identifying a list of candidate
6 shapes, said candidate shapes disposed on layers adjacent to aggressor
7 planes; for calculating an effective capacitance coupling the candidate
8 shapes to adjacent noise-generating planes; for determining a ratio of each
9 said calculated effective capacitance and a decoupling capacitance
10 connecting the respective candidate shape to a reference plane; for sorting
11 said determined ratios to produce a ranked list of the candidate shapes; and
12 a user interface for displaying said ranked list of the candidate shapes
13 for user review.

1 15. Apparatus for implementing automated detection of excess
2 shape coupling as recited in claim 14 wherein said ranked list of the
3 candidate shapes includes shape names with said determined ratio, an area,
4 and a location of the candidate shapes.

1 16. Apparatus for implementing automated detection of excess
2 shape coupling as recited in claim 14 wherein each said candidate shape
3 has a predefined assigned name indicating usage.